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The writer believes that the practice of making measures under poor observing conditions or with inadequate instruments is largely responsible for the discordant observations.

COMET *b* 1916 (Wolf): *R. T. Crawford* and *D. Alter.* See below.

NOTE ON AETHRA: *D. Alter.* See page 210.

JOHN WINTHROP (1714-1779), AMERICA'S FIRST ASTRONOMER AND THE SCIENCE OF HIS PERIOD: *F. E. Brasch.* See page 153.

NOTES FROM PACIFIC COAST OBSERVATORIES.

COMET *b* 1916 *(Wolf).*

The second comet of the year 1916 was discovered photographically by Wolf at Heidelberg, the evening of April 27th. It is of peculiar interest in several respects.

After the announcement of the discovery Professor Barnard at the Yerkes Observatory found that he had the object on plates he had taken three nights previous to the discovery plate of Wolf. This observation of April 24 is the earliest one available.

The computations show that at discovery the comet was about 4.1 astronomical units distant from the Earth and nearly 4.9 astronomical units from the Sun, distances greater than those of any other comet at the time of discovery. Even Halley's Comet, whose position for its last return was quite accurately known, was picked up on this return when a little over three astronomical units away. It was found eight months before its perihelion passage date, while Wolf's Comet, altho unexpected, was discovered nearly fourteen months before it will come to perihelion.

On account of the great distance at the time of discovery and the consequent slow motion of the comet, a large range of solutions was possible for orbits that would represent the early observations. This was very apparent in the progress of the first computations. Were it not for the fact that the

observations are of an unusual degree of accuracy a much longer arc than was used would have been necessary to obtain even an approximate idea as to the true character of the orbit. The orbit computed at the Students' Observatory in Berkeley is based upon observations of April 24th, May 10th, and May 23d. This, together with an ephemeris extending to August 29, has been published in *Lick Observatory Bulletin* No. 282. From the manner in which later observations are represented by this orbit it will be noted that these elements are very satisfactory for a preliminary orbit and show very approximately the character of the path. They are undoubtedly good enough to furnish a place for finding the comet again about the first of December, 1916, after it will have passed conjunction (the latter part of October). A second orbit will therefore not be computed here until after the comet has been observed again in December. An ephemeris based upon the present elements will be computed beginning about the first of December when the comet will be a morning object about an hour and twenty minutes ahead of the Sun.

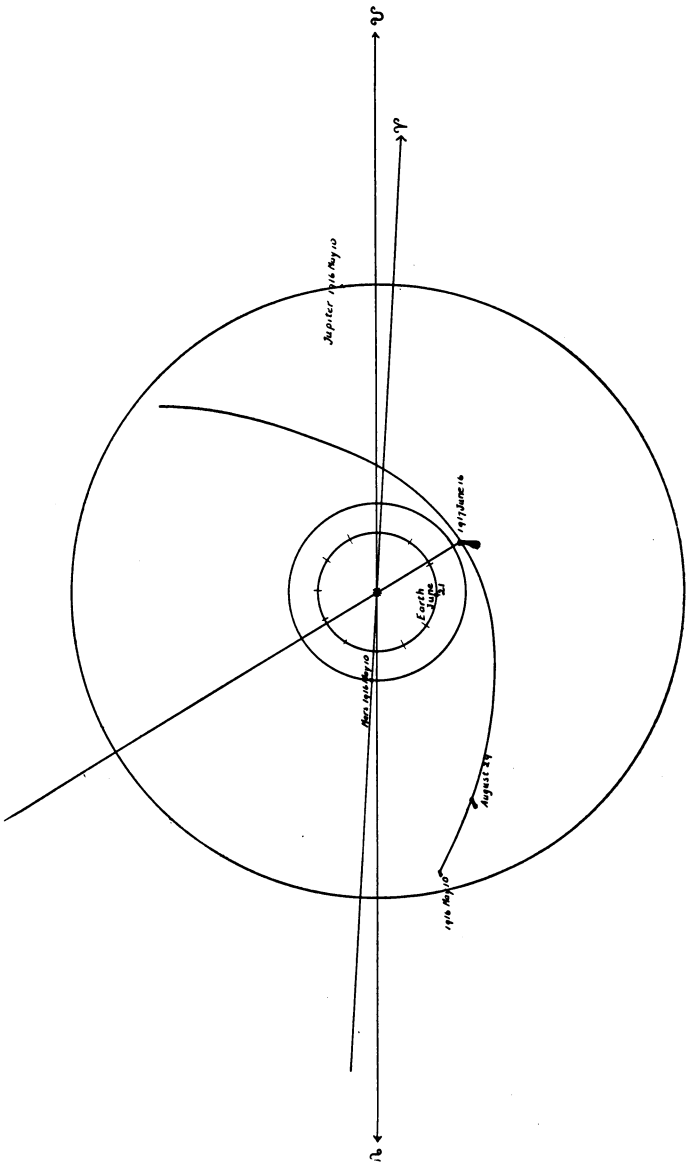
Referring again to the range of solutions, a brief sketch of the course of the computation may be of interest. The first three observations available here were those of April 24th, May 4th, and May 10th. We had just computed an orbit based upon these observations when Van Biesbroeck's elliptic elements were received. Ours was a parabola with an inclination of 95° and giving a perihelion date in 1914. This parabola represented very satisfactorily not only the three observations upon which it was based but also another observation by Barnard made May 6th. These two sets of elements were so radically different that it was decided to withhold our parabola and wait for another observation giving a longer arc. Cloudy weather at Mount Hamilton prevented our obtaining an observation from the Lick Observatory, but Director Frost of the Yerkes Observatory kindly sent us one of May 23d by Van Biesbroeck. Using this and the observations of April 24th and May 10th the elements referred to as giving the character of the orbit were computed.

As Van Biesbroeck's elliptic elements (short period) also gave a satisfactory representation of the early observations it was decided to investigate what period would be possible for an ellipse to give a satisfactory representation of the observations from April 24th to May 23d. We used Leuschner's Method of Conditioned Solutions, wherein an orbit of any chosen period can be forced thru three right ascensions and two declinations, leaving the representation of the remaining declination to show the degree of satisfaction of the conditioned solution.

Using a period of seven years the orbit came out practically the same as Van Biesbroeck's, but left a residual of 31″ in the first declination (the one not used in the solution). Adopting a period of fifty years the residual in the first declination amounted to 7″. As this is about the limit of accumulated error of observation allowable in the three observations (as mentioned, they are of a high degree of accuracy) it can be safely said that the available observations can not be represented satisfactorily by an ellipse with a period much less than fifty years. The observations used are perfectly represented by an orbit slightly hyperbolic. We can therefore safely say that for the observations at hand the range of possible solutions is from an ellipse with a period of about fifty years to an orbit slightly hyperbolic.

An inspection of the drawing of the orbit of the comet together with the orbits of the Earth, *Mars* and *Jupiter* will reveal several interesting points. In this drawing the inclination of 25° to the ecliptic has been neglected.

It will be seen that at discovery the comet was nearly at *Jupiter's* distance from the Sun. The position of the Earth at the time was such that for a few months following discovery time the distance between the comet and the Earth varied but little; they were traveling in nearly the same direction, and the Earth going the faster made the geocentric distance increase. Conjunction will be reached the latter part of October. The comet will undoubtedly be lost in the twilight early in September. After conjunction the comet will probably be reobserved as a morning object in December.



Wolf's Comet 1916

The differences in right ascension between the comet and the Sun at this time are as follows:

1916 Gr. M. T.	$\Delta\alpha$ ($\odot$ — Comet)	Br.
Nov. 29.5	$1^h\ 16^m$	2.96
Dec. 7.5	1 37	3.32
Dec. 15.5	1 59	3.74
Dec. 23.5	2 20	4.25
Dec. 31.5	2 41	4.86

Brightness May 10 = 1.00.

From this time on the brightness will increase rapidly and the comet will be in favorable position for observation during the whole of the year 1917, coming to opposition soon after perihelion passage, which occurs 1917, June 16, at which time the comet will probably be visible to the unaided eye. It will be visible for telescopic observation until February or March, 1918, when it will again be lost in the Sun's light, approaching conjunction. By July or August, 1918, it is probable that the comet can again be picked up and observed with large telescopes during the remainder of that year, when it will be about as bright as at discovery. From these facts it is seen that the comet will be observable over a stretch of nearly three years.

For the sake of completeness the elements published in *Lick Observatory Bulletin No. 282* are repeated here:

$$T = 1917\ \text{June}\ 16.4806\ \text{Gr. M. T.}$$
$$\left.\begin{aligned}\omega &= 120^\circ\ 37'\ 07''.9\\ \Omega &= 183\ \ 16\ \ 58\ .8\\ i &= \ \ 25\ \ 40\ \ 06\ .4\end{aligned}\right\}\ 1916.0$$
$$\log q = 0.226855$$

It may be added that the plane is oriented so that its inclination to the equator is only $2^\circ\ 36'$.

To show how well our orbit is holding and to attest to the great accuracy of the observations at hand at the present time the following table of observations made since May 23 together with their representation by the orbit is here given:

1916 Gr. M. T.	Comet's apparent α	Comet's apparent δ	(O—C) $\cos\delta\Delta\alpha$	(O—C) $\Delta\delta$	Observer
May 27.6893	$12^h\ 29^m\ 48^s.6$	$+4^\circ\ 18'\ 17''$	—0s.1	0″	Barnard
27.7933	12 29 47 .4	4 18 30	—0.1	—2	Aitken
28.6536	12 29 38 .8	4 20 28	+0.1	—2	Van Biesbroeck
May 30.7009	12 29 19 .9	4 24 51	+0.1	—2	Van Biesbroeck
June 4.7197	12 28 47 .9	4 33 47	+0.1	+1	Van Biesbroeck
17.6493	12 28 59 .2	4 45 12	+0.2	+1	Barnard
21.6709	12 29 30 .2	4 45 27	+0.1	0	Barnard
24.6369	12 30 01 .3	4 44 43	+0.3	+1	Barnard
June 28.6400	12 30 54 .2	4 42 27	+0.1	—1	Barnard
July 1.6559	12 31 42 .7	4 39 49	+0.2	—1	Barnard
July 5.6369	12 32 57 .2	+4 35 11	+0.3	—1	Barnard

Berkeley Astronomical Department,
July 17, 1916.

R. T. CRAWFORD,
DINSMORE ALTER.